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Study of Physico Chemical Parameters of Kolar Dam in Different Seasons

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ABSTRACT

India is one among those developing countries which are facing severe problem of water pollution. Most of the industries discharge their effluent without proper treatment into nearby water bodies which detoriates the quality of water. The safe portable water is absolutely essential for healthy life. The study area selected was Kolar reservoir of Bhopal, (Madhya Pradesh, India). Kolar reservoir is one of the important sources of drinking water supply for the Bhopal city. This reservoir (latitude 22° 57' 37" and longitude 77° 20' 24") has a catchment area of 508 km^2. It fulfills the drinking water needs of about 65 per cent of the city population. In addition to this the dam also serves the irrigation purpose of Bhopal city and the surrounding areas. Attempts were made to study and analyze the physico-chemical characteristics of the water. Water Samples were collected and analysed (APHA1995[1], NEERI 1991[2]) for the physico–chemical parameters, temperature, pH, turbidity, total alkalinity, total hardness, calcium hardness as $CaCO_3$, magnesium hardness as $CaCO_3$, chlorides, iron, manganese and sulphate in three different seasons to ascertain the drinking water quality. The study reveals that the physico chemical parameters of water tested are well with in the WHO limits except for turbidity and it is a good quality for drinking, irrigation and fish culture purposes.

Keywords: Kolar water supply, water quality, physico chemical parameters, drinking water standard etc.

INTRODUCTION

Bhopal, the capital of Madhya Pradesh, is a beautiful city with many water bodies in and around it. It is the 11th century city Bhojpal, founded by Raja Bhoj, but the present city was established by an Afghan soldier, Dost Mohammed (1707-1740). Bhopal is one of the fastest growing cities in the country. It is continuously losing its grace and beauty because of industrialization,

urbanization and densification of activities. The situation is becoming worse in coming years. There is an immediate need to address the issue of urban water pollution and to provide quality water to the people of Bhopal. Water quality is an index of health and well being of a society. Industrialization, urbanization and modern agriculture practices have direct impact on the water resources. These factors influence the water resources quantitatively and qualitatively.

The study area selected is Kolar dam of Bhopal city. Kolar Dam, a major masonary dam, is located about 32 km from Bhopal and at the same level as Bhopal around 1600 ft, near Lawakhedi village in Sehore District. Constructed across the Kolar River near Birpur, a tributary of Narmada on the right bank, the dam is about 45 m high. The area around the reservoir is covered with thick forest. Thus the water of the reservoir is runoff from the forest. The submerged area was also a part of the forest before the construction of the reservoir and thus numbers of trees are submerged in the reservoir. This reservoir (latitude 22° 57' 37" and longitude 77° 20' 24") has a catchment area of 508 km^2. The gross storage capacity is 270 Mcm and live storage capacity is 265 Mcm. About 270 million cubic meter (mcm) water is stored in Kolar Dam at full tank level. The Dam is used for supplying drinking water to Bhopal city. In addition to this the dam also serves the irrigation purpose of Bhopal city and the surrounding areas. At Kolar Dam, when the water level increases the mark of 462 meter then its water is released. After the release of water from Kolar, the water reaches the Narmada River through Ratapani Sanctuary. Kolar river joins Narmada River at Nilkanth.

MATERIAL AND METHOD

The study areas selected was Kolar dam of Bhopal (M.P). Water samples was analyzed for 11 parameters such as temperature, turbidity, pH, total alkalinity, chloride, total hardness, calcium hardness, magnesium hardness, iron, manganese and sulphate. Sampling and physicochemical investigation was carried out according to standard methods (APHA 1995; NEERI 1991). The results were carefully studied and analyzed and compared with WHO Standards & BIS Standards with special reference to drinking suitability.

- Water temperature was recorded in the field using sensitive mercury thermometer.
- The pH of the samples was determined using digital pH meter.
- Turbidity was determined by Nephelo - turbidity meter.
- Total Hardness, calcium hardness and magnesium hardness was determined titrimetrically using EDTA method (APHA 1995).
- Total Alkalinity was determined by titrimetric method.
- Chlorides were determined by Mohr's argentometry method (APHA 1995).
- Iron, manganese and sulphate was determined by spectrophotometrically.

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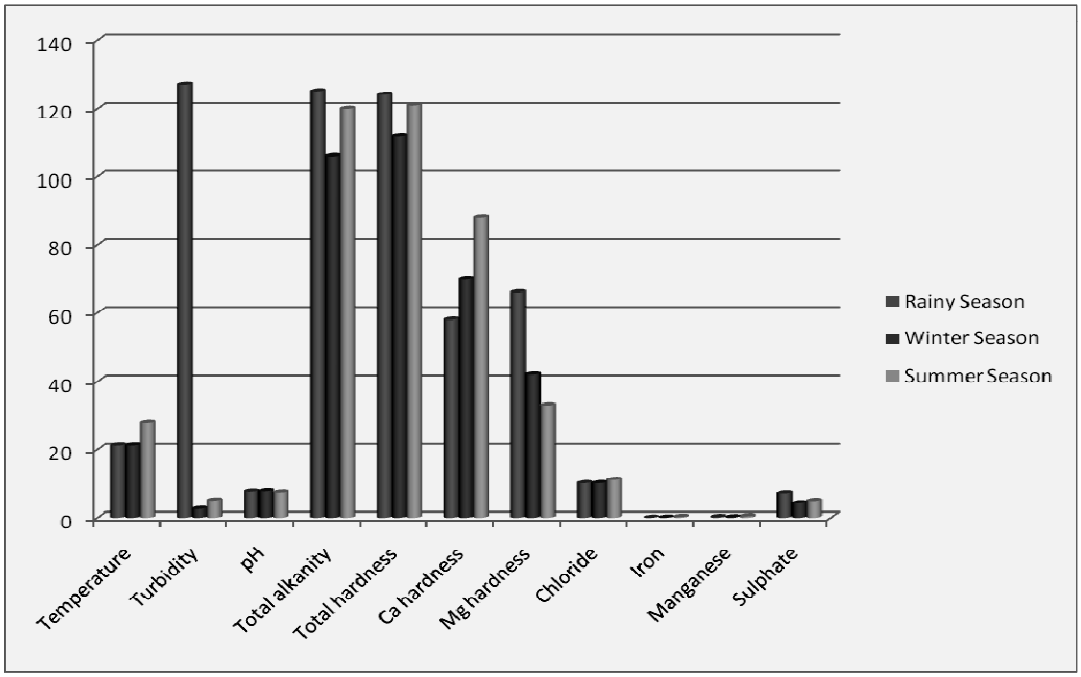
Table 1: Seasonal study of physico-chemical parameters of Kolar dam

S.No	Parameters	WHO Standards	BIS Standards	Rainy Season	Winter Season	Summer Season
1	Temperature	-	-	21.2	21.2	27.8
2	Turbidity	5	10	127	2.5	5.0
3	pH	7-8.5	6.5-8.5	7.70	7.84	7.44
4	Total alkanity	200	600	125	106	120
5	Total hardness	100	600	124	112	121
6	Ca hardness	75	200	58	70	88
7	Mg hardness	70	70	66	42	33
8	Chlorides	250	1000	10	10	11
9	Iron	1.0	1.0	_	0.04	0.27
10	Manganese	0.5	0.5	0.21	0.15	0.45
11	Sulphate	250	400	7.2	4.2	4.9



Seasonal variation in the physico-chemical parameters

RESULT & DICUSSION

The observations and results of analysis of various physico-chemical parameters of water of Kolar dam was summarized in table 1 and they are also analyzed graphically. The data revealed that there were considerable variations in physico-chemical parameters from season to season. A comparison of the various physico-chemical characteristics of the studied water samples has been made with the WHO (1984)[3] and BIS (1998)[4] standards. These parameters are discussed below:

Temperature

The maximum temperature of water was recorded in summer season which is 27.8°C. The variation in water temperature may be due to difference in timing of collection and the influence of season (Jayaraman et al. 2003)[5].Temperature controls behavioral characteristics of organisms, solubility of gases and salts in water. No other factor has so much influence as temperature (Welch 1952)[6].

Turbidity

The amount of suspended material in water can be measured by collecting the solids or assessing the relative light transmission of the suspension. The increased opaqueness is caused by increased sediment which negatively affect many aquatic organisms. Both algal production and fish reproduction and feeding can become diminished and some organisms, like shell-fish (continual filter-feeders) can become choked by sediment and eventually die in heavily turbid waters. The maximum value of turbidity was observed in rainy season (127 NTU) which is much higher than the permissible limit as prescribed by WHO. Water may not be safe from hygienic point of view as under such conditions it becomes very difficult to maintain the minimum desirable limit of chlorine in the water.

Hydrogen Ion concentration pH:

pH is a unit that expresses the strength of a solution based on its acidic or basic properties. Aquatic organisms can only function in a particular range of pH, and become forced to relocate when the surrounding water changes. Pollution from burning fossil fuels increases the amounts of sulphur and nitrogen oxides introduced into the water, thereby increasing the overall acidity. WHO has recommended maximum permissible limit of pH from 6.5 to 9.2 (De, 2002)[7]. pH correction after the treatment of water can significantly reduce the corrosion and incrustration problems. The pH controls the chemical state of many nutrient including dissolved oxygen, phosphate, nitrate etc. (Goldmann and Horne, 1983). It regulates most of the biological processes and biochemical reaction. (Verma et al., 2006)[8]. The pH was found in the range of 7.844 to 7.84 i.e. it has pH values within the desirable and suitable range.

Total alkalinity

The alkalinity of water is its capacity to neutralize acids. The maximum alkalinity was recorded as 125 ppm in rainy season. BIS has set a desirable level of alkalinity in drinking water to be 200 ppm where as its value has been prescribed to be 600 ppm in the absence of alternative source. The alkalinity fluctuated in accordance with the fluctuation in the pollution load.

Total hardness

The maximum total hardness was recorded as 124 ppm in rainy season and the minimum value was recorded as 112 ppm in winter season. The hardness of water is not a pollution parameter but indicates water quality. Hardness is an important parameter in decreasing the toxic effects of poisonous elements. It is within desirable limit. BIS has prescribed desirable limit of total hardness 300 mg/l and permissible limit in the absence of alternate source 600 mg/l (De, 2002).

Calcium hardness

Its value was found in the range of 58 mg/l to 88 mg/l & it is with in the permissible limit as prescribed by WHO.

Magnesium hardness

Its value was found in the range of 33 mg/l to 66 mg/l. Its value is with in the permissible limit as prescribed by WHO.

Chloride

Chloride occurs in all natural waters in widely varying concentrations. The chloride contents normally increases as the mineral contents increases (Dubey 2003)[9]. In the present study the chloride concentrations were found in the range of 10-11 ppm.

Iron

Its value was found in the range of 0 mg/l to 0.27mg/l. It is with in the permissible limit as prescribed by WHO.

Manganese

Manganese is essential element which does not occur as a metal naturally but it is found in the form of salts and minerals. Its deficiency cause bones abnormalities and reproductive dysfunction. The maximum concentration of manganese was recorded as 0.45 ppm in summer season and the minimum value was recorded as 0.21 ppm in rainy season, which is well with in the permissible limits as prescribed by WHO.

Sulphate

It usually occurs in natural waters. The presence of sodium sulphate and magnesium sulphate in drinking water beyond the permissible limits may cause cathartic action. The value of sulphate was found in the range of 4.2 mg/l to 7.2 mg/l. Its value is much lower than the permissible limit as prescribed by WHO.

CONCLUSION

The results indicate that the value of different parameters like temperature, pH, total alkalinity, chloride, total hardness, calcium hardness, magnesium hardness, iron, sulphate, manganese are found with in the permissible limit as per WHO standards & BIS standards. There is not much variation in the values of various parameters in different seasons except for turbidity which has a very high value in rainy season. The analysis indicates that the water of Kolar reservoir is moderately soft with moderate alkalinity. By observing the results in different seasons it can also be concluded that the parameters which were taken for the study of water quality are below the pollution level and it can be used for various purposes like domestic, agricultural, industrial etc. The overall water quality of Kolar reservoir is much better as it is surrounded by thick forest. The water quality parameter of Kolar reservoir shows its good nature (Shukla 1996)[10].

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